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Radio Concerts and the "Novice"

To say that Radio is "sweeping" the North American continent is to most people to-day merely a repetition of something they already know. The statement, however, warrants consideration if only by way of preparing suitable answers to any of the hundreds of questions that are being asked. Is it only a fad? How long will it last? What does it cost? What do you require? and so on, ad infinitum.

Radio in itself is not the "new" thing most people imagine. Years ago some, at least, of the various theories which go to make up present day Radio science were worked out in the laboratories of various Old World scientists. It remained, however, for Marconi, some twenty years ago, to combine these laboratory ideas and to give to the world its first conception of the commercial possibilities of "wireless" or "Radio." Since then and up till the Great War the development of the new science, though full of historical and technical interest to the scientific investigator, did not bring out any points which would tend to make it generally popular.

The huge concentrated effort made necessary by the war no doubt advanced the "coming" of Radio by some fifty years. As soon as Government restrictions were removed after the end of the war, the number of amateurs and experimenters grew very rapidly. Of course, what tended to increase its popularity was Radio-telephony as opposed to Radio-telegraphy. Even then, many did not expect so soon the great demand for Radio sets. But the great broadcasting stations came into being, and the Radio manufacturers, caught unprepared, were swamped with orders. The writer, just prior to the present rush, talked with several large Radio manufacturers. They practically all agreed that good business was in store for them, but in the future—perhaps two years hence, or at least one year. However, "Radio" was too good to be kept back. To-day there are millions of dollars invested in it. Its momentum has probably done more than anything to move again the wheels of industry.

Radio has passed its term of approbation, it has received the popular approval and now takes its place, not as a luxury, but as a necessity in the advancement of civilization. Its bright future is assured. Only the trend of its development remains to be worked out. It has its own field and will probably not fulfil all the fantastic hopes held out for it by some. But the automobile has not replaced the railway train. Radio, however, no doubt possesses possibilities of entertainment and instruction not yet comprehended even by those who are most familiar with present wireless developments.

The man on the street now wants to know how he can hear these Radio concerts, etc., that everyone is discussing. Here he is absolutely at a loss. Much of the Radio advertising in the past was meant to appeal only to the amateur who had already delved into the supposed mysteries of the game. The public are further led astray and confused by the publication of articles citing cases of freak reception. One almost wonders who will be the first to tell of an enthusiast who wet his finger, held it up, and "received" 'Frisco from Buffalo. Transmitting and receiving by Radio is, in one sense, merely a question of power used at the transmitting station and the sensitivity of the receiving set. If you want to take a number of good pictures you buy a camera with a good lens, although perhaps once you would get a very good result with a cheap camera. So with a Radio receiving set the cost increases with the sensitivity. You can buy complete receiving sets from about thirty dollars to two hundred and fifty. In comparing prices do not be led astray by sets which appear to be cheap, but are really only incomplete and perhaps more expensive in the long run.

Complete receiving sets are what most men in the "novice" class require. For such they are after all the cheapest and most satisfactory. Parts to be assembled are for the amateur who has time and inclination for experimenting. Here, again, the public are often led astray by reports of some alleged "novice" who, at the cost of some ten dollars and three hours' time, constructed a set with which he heard the Eiffel Tower. The fishing season is here again, but it is now outclassed by Radio as a producer of "big ones." The complete receiving set is the one for the average "novice."

Protection of Home, Self, and Radio Set Against Danger from Atmospheric Electricity

By G. K. Thompson—Radio Superintendent of the Amrad Company

Part I.

If your radio installation is not already installed according to regulations, you should attend to the matter at once. The regulations are in force the year round and should be complied with as far as possible. That they are not complied with is a well-known fact, but this negligence means that, after the first thunderclap, thousands of people will storm dealers in radio equipment for protective devices and their meagre supplies will be exhausted within a few hours.

One of the first questions which comes into the mind of the would-be radio user concerns lightning. "Will my antenna attract lightning and cause my home to be struck?" he asks. To the general public wireless and lightning seem to be twin brothers,—probably because the manifestations of both are uncanny and mysterious. Hoisting a radio antenna over your property does not endanger your dwelling, your instruments, or your family if a few simple precautions are observed. You have never felt apprehensive over the presence of the telephone wire running from the pole on the sidewalk to your house. You do not regard the bell wire circuit running from the front door to the kitchen as a lightning conductor, nor have you been nervous over the presence of a wire clothesline in your back yard, the tin roof over your head or the metal gutters and leader pipes. All these common and familiar metal surfaces and conductors will convey electricity from point to point. The average radio antenna differs very little from these other conductors and objects, and insofar as lightning is concerned the radio antenna is much less likely to be struck during a heavy thunder storm.

Let us consider the electrical action which takes place in the antenna before and during a summer thunder storm. There is always a certain amount of atmospheric electricity present in the air. In cold weather the amount is very slight and manifests itself in the radio set by what is familiarly known as static. When warm weather comes atmospheric electricity is generated in much larger quantities. The intense heat of the summer sun evaporates the moisture on the surface of the earth and water from ponds and lakes very rapidly. This evaporated moisture or vapor, becoming heated, rises to the upper atmosphere, and upon reaching the higher levels where the temperature is lower, the water vapor condenses into minute drops of moisture and forms clouds. Each moisture particle becomes charged with a very small amount of electricity. As the moisture particles in the upper air become more dense the particles crowd together and one particle combines with another. This combination increases the electrical charge on each particle until finally a thunder cloud is formed which is very highly charged with electricity.

It is a known fact that when thunder storms are in formation electric discharges occur within the cloud. These discharges are popularly known as sheet lightning. Every time such a discharge takes place, radio waves are emanated and these waves impinge upon your antenna, causing a sharp crash or crackle in the telephone receivers if you happen to be listening in.

A thunder cloud must be regarded as a huge bubble containing electricity. Discharges are constantly taking place within the bubble and increasing in size. When a certain critical point is reached, the bubble bursts, the pent-up electricity discharges in one swoop to the earth, and we hear a mighty thunderclap. If this lightning bolt strikes within one-half mile of your antenna, considerable current will be induced in your aerial system. This induced current will pass harmlessly to the ground and you will be unconscious of its presence if you have taken the proper precautions.

Let us consider the great bubble once more. If we prick tiny holes in this bubble while it is in process of formation, the pent-up electricity will gradually discharge. If we prick enough holes in the bubble, the electric charge may leak away so fast that the quantity of electricity within may never reach the point where the bubble will burst. The function of the common lightning rod and the properly grounded or protected antenna is to prick holes in the great electric bubble in the sky, and convey its charge silently to the ground. For this purpose the average radio antenna is exactly as effective as the lightning rod.

"What will happen if a lightning bolt actually strikes my antenna"" is a familiar question. Let us consider the nature of a lightning bolt. The heavy thunderclap which attends its appearance gives the impression of tremendous energy. It is true that lightning is destructive, but as a matter of fact its bark deceives one of its might. The average lightning bolt contains about as much energy as represented in a pint of gasoline. The only difference is that the energy of lightning is exerted instantaneously. Take, for instance, a cupful of gasoline and ignite it under a sauce pan containing a tallow candle. The heat of the burning gasoline will melt the candle. The phenomenon is silent and harmless. Take another cupful of gasoline and dump it into the gas tank of the family flivver, crank up, and drive thirty miles an hour, head-on into a concrete wall. The effect is startling. Even Henry himself could not put together the remains and make them rattle once more, yet the energy involved was no more than that necessary to melt the tallow candle. The essential difference lies in the fact that in the first case the energy was released gradually, and in the second case the energy was released instantaneously. A bolt of lightning represents an electrical collision. This accounts for its many strange antics, such as stripping the soles from shoes of persons struck, smashing crockery, or ripping off the wall paper.

The average lightning bolt never plays according to Hoyle, and if it does ever strike your antenna it will probably not follow the direct low resistance path to ground which you have carefully provided, but instead may jump to the chicken coop, causing the feathers to fly, or wreck the gas stove or refrigerator. The lightning, if it ever strikes, will be blissfully oblivious to the fact that you ever had a radio set or antenna or ever thought of having one. You may have a fine nickel-plated bumper on the front of your automobile, but if you collided with a locomotive going 60 miles an hour, it would be difficult to find the remains of the car let alone the nickel-plated bumper.

Part II.

So far as your radio installation is concerned, you should harbor no fear that it will attract lightning. The

chances of lightning striking your home this summer are no greater than the chances last summer. You should make it a point, however, to install such safety devices as will render harmless the currents induced in your antenna by lightning bolts striking in the neighborhood.

We will consider separately the precautions necessary to protect your home, yourself, and your radio set against any slight derangement from atmospheric electricity. With your home in mind, take the following procedure:

First, install a lightning switch or a grounded short gap of approved design. Avoid the purchase of slate base switches, gaps, or any other devices which do not support the ground conductor at least five inches out from the wall or building.

Second, install a ground conductor running as directly as possible to a good ground connection. A ground connection may be a water pipe, several galvanized pipes driven in the soil and connected together, or metal plates buried two or three feet below the surface of the earth. The water pipe connection is generally regarded as satisfactory and sufficient. The ground conductor running from the lightning switch or grounded short gap to the earth connection must be of sufficient size to conform with the regulations, which specify that the periphery of such a conductor be at least three-quarters of an inch. To comply exactly with the specifications you should use a No. 2 copper wire, copper tubing one-quarter inch outside diameter, or copper ribbon three-eighths of an inch wide. Of the three, copper ribbon is the least expensive. The ground conductor must clear the wall of the building at all points by at least five inches and should be mounted on insulators which provide this amount of clearance. All connections should be soldered.

Third, have the installation approved by your local inspector, so that in case any damage to the building by lightning ever comes to pass, the validity of the radio installation will not be questioned.

Many people are at a loss to decide between a lightning switch and a grounded short gap. Both of these devices, properly constructed, are approved by the National Electric Code. Let us compare the merits and demerits of both.

The lightning switch costs more to buy. It must be operated manually to provide the proper protection, but when thrown to the grounded position it provides a more positive protection than the grounded short gap. With the lightning switch in a closed position, a heavy electric surge induced in the antenna by a bolt of lightning striking nearby, will pass swiftly to ground, and damage to your property will be a very remote possibility indeed.

The grounded short gap costs less to buy and its operation is automatic. It does not, however, discourage a discharge from entering the building, as the wire leading to the receiving set is permanently connected directly to the antenna. When a grounded short gap is employed, high potentials are often built up within a receiving set when a thunder storm is in progress and the insulation within the set is subjected to heavy strains. On the other hand, if one must operate his set when a thunder storm is in progress, it is safer to operate it when connected to a grounded short gap than when connected to a lightning switch.

We will now consider the protection of the radio set itself against possible damage from heavy electrical discharges. The best precaution to follow is to disconnect antenna and ground lead wires from the terminals of the set before the thunder storm breaks. If you do not care to disconnect the set, a protected gap should be purchased and connected across the antenna and ground terminals on the instrument. A substitute for such a gap can be provided in the form of a burnt out flash light bulb screwed into a miniature base, the terminals on the base being permanently connected to the antenna and ground terminals on the receiving set. If the latter terminals are mounted close together a discharge gap may be provided by clamping two ordinary sewing needles in the terminals, separating the points by the thickness of a piece of paper. For maximum protection, however, complete disconnection of the receiving set from antenna and ground connections is advised.

As for self protection, we again emphasize the remote possibility of a personal encounter with lightning due to the existence of radio equipment in your home. For safety's sake, however, respect these few don'ts and you need never suffer discomfort.

Don't attempt to operate the set while a local thunderstorm is in progress. You can hear nothing but static discharges anyway, the elimination of which are entirely beyond your control.

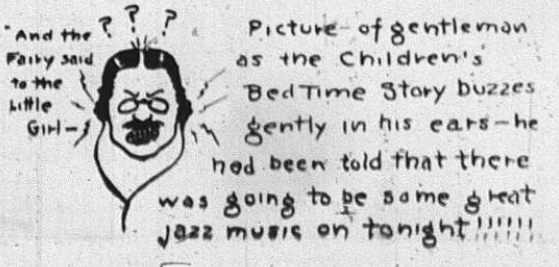
Don't touch the ground wire or the antenna lead wire while the storm is in progress.

Observe these precautions also: If you use a lightning switch, throw it over to ground before the storm strikes. Do not touch the switch while the storm is in progress, even though it may not be set in the grounded position. Keep the window next to the lightning switch or grounded gap closed until storm is over. If your antenna lead wire is brought in under the window without any insulating tube, disconnect it from the receiving set and throw the free end out of the window until the storm is over.

There is much criticism of the present regulations respecting protective devices for the radio antenna. In many instances it is impossible or at least impracticable to comply with all the specifications in the regulations. Some of the requirements serve no useful purpose. Others require the purchase of unnecessarily costly protective devices. The framers of the regulations realize already that some revisions must be made. Meantime you should make every effort to comply with the spirit of the regulations as they are framed in your personal interest and in the interests of the community.

The chances of you, your set, or your property ever being injured by lightning are very remote. This summer lightning will play its pranks just as if radio sets in 500,000 American homes were undreamed of. If, however, lightning should cause damage where radio is installed, the incident will call for a scare head in the newspapers, simply because Radio at this time is so sharply focused in the public eye. Do not, through neglect, become involved in sensational reports which only encourage the false belief that radio antenna attract lightning.

The telephone company installs its instrument in your home with simple, inexpensive, approved protective devices. But you are warned not to use the telephone during a thunder storm. Regard the use and installation of your radio in exactly the same way and you will be as safe as a cricket in the Mammouth Cave.



ELECTROLYTIC RECTIFIERS

Abstract of a paper read before Radio Research Club of Canada by H. H. Moor, and including subsequent discussion.

There is no greater influence affecting the development of any device than its commercial application. Let an article become extensively used and it will be intensively developed. The electrolytic rectifier, unfortunately, does not belong to this class. When first designed and developed it was promised a brilliant future, but the fact that it had no commercial development showed that the rectifier had more interest than value.

However, the extensive use of the thermionic valve as an oscillator, and the necessity of a high potential d. c. for modulated c. w. transmission, has caused the radio engineer to put on his "thinking cap" and solve another problem. The motor generator set, although perhaps the most efficient is also the most costly. The use of cells, although ideal, in that they give constant emf., is impossible, on account of their bulk, expense and care. The ease with which a. c. can be transformed from one voltage to another is certainly an attraction, but the rectification and the "smoothing out" are difficulties that have not been entirely overcome. Rectifying tubes have been on the market some time, but their short life, the expense of replacement, and other factors, have not made this device very popular on this account. I understand that another rectifying tube is being placed on the market, and although it does not require a filament, nevertheless its life is limited. As there is an approximate drop of 100 volts across it, the efficiency will be low on low voltages.

The electrolytic rectifier, or the properties of certain electrolytic systems to have a much higher conductivity in one direction than in the other, is an old phenomenon. As is so often the case, this old phenomenon, in the light of development in other fields, assumes a new importance. In the case of the aluminum rectifier, this is particularly true. Its very low cost and its extreme simplicity and ruggedness have made it very popular, especially in amateur circles, as a rectifier of alternating current, in spite of its very doubtful efficiency.

Before taking up the subject of the aluminum rectifier, I propose to sketch in a hasty manner the theory of electrolytic dissociation in solution.

We are all familiar with the fact that most substances dissolve in water, but we seldom stop to consider why a solution of common salt will conduct electricity, while a sugar solution will not. The former we term an electrolyte, the latter a non-electrolyte.

It can be shown, by physical chemical means, such as elevation of boiling point or depression of freezing point, that when acids, bases and salts dissolve in water, some of the dissolved substance is broken up or dissociated, the products of this dissociation being called ions. These ions bear a charge of electricity, the metallic and hydrogen ions having a positive charge, the ions of acid radicals and of "hydroxyl" being negative. It is due to these ions that a salt solution, or more generally, an electrolyte, is a conductor. In a graphic manner this is what happens:—

Sugar—dissolved sugar.

Salt—dissolved salt—dissociated into ions.

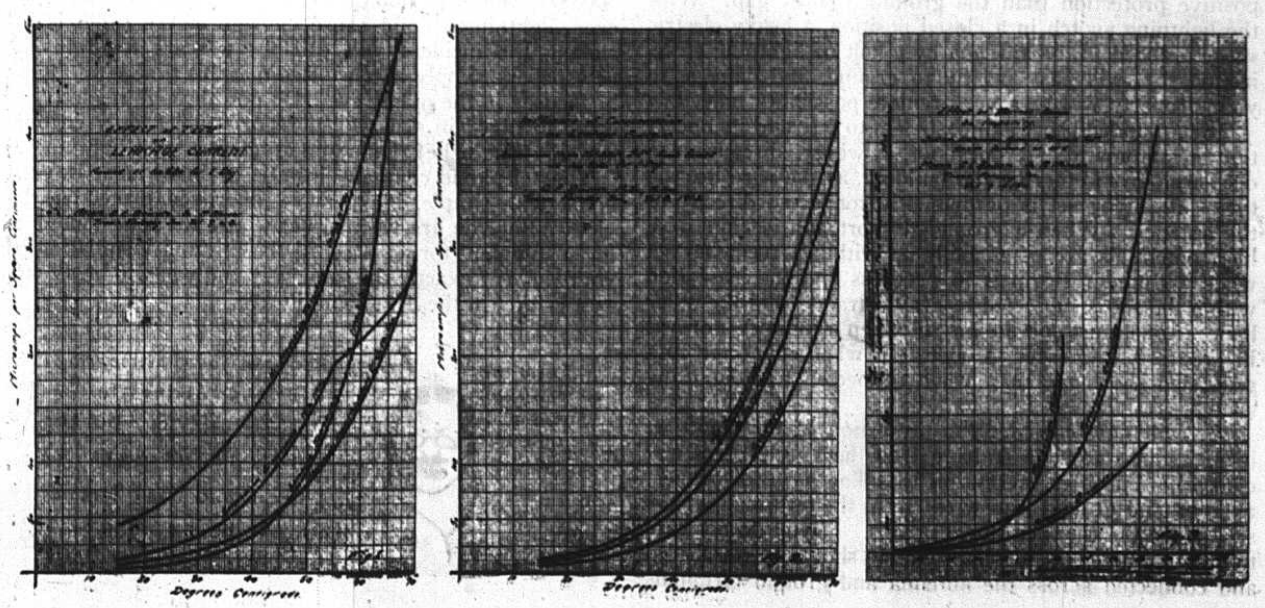
The common properties of acids, such as their sour taste, their action on metals and on blue litmus, are ascribed to the action of the hydrogen ion. Concentrated sulphuric acid, due to the absence of hydrogen ion, has no action on iron, etc.

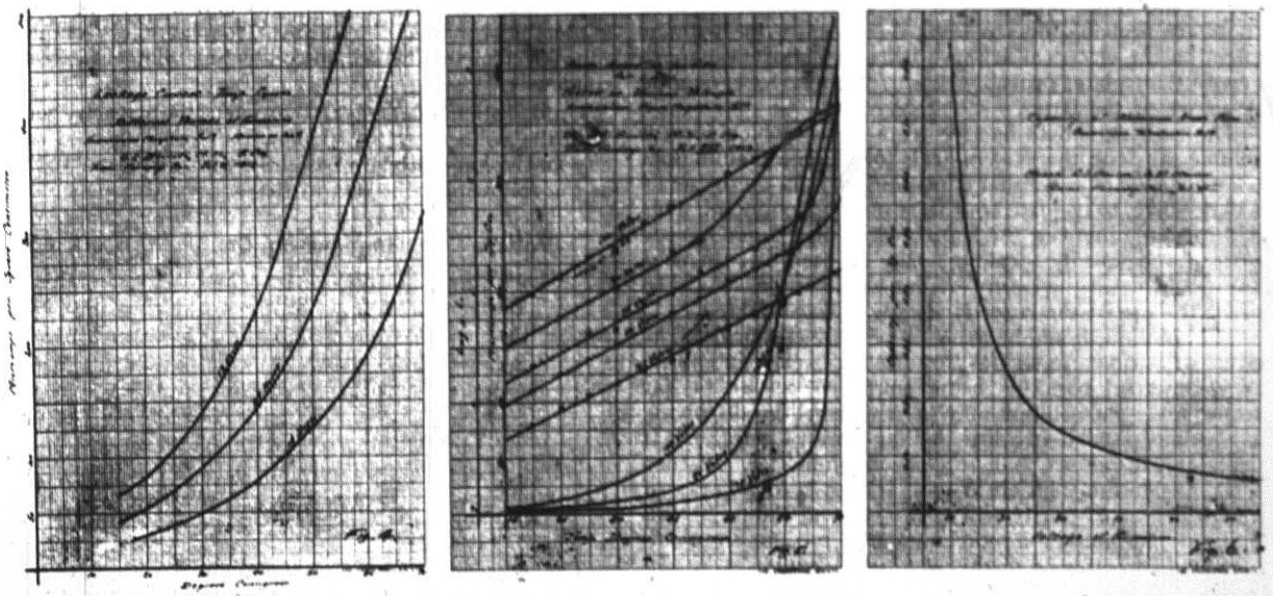
Similarly, the common properties of bases are due to the hydroxyl group—OH.

By a weak acid, such as boracic acid, or a weak base, we mean one that is only slightly dissociated.

Water is dissociated, very, very slightly, yielding hydrogen ion and hydroxyl ion, so that it is as much (or as little) an acid as a base.

What happens when two wires, connected to a battery, are dipped into copper sulphate solution? We all know that copper plates out on one wire, while the other wire dissolves.





In the copper sulphate solution, we have ions bearing either a positive charge or a negative charge of electricity. We know that unlike charges attract. Thus, the positively charged copper ion is attracted to the negative wire, gives up itc charge, and becomes metallic copper The negatively charged sulphate ion is attracted to the positive wire, uniting with some copper (if it is a copper wire) to reform copper sulphate.

When we come to consider a system having aluminum as anode, it is not so beautifully simple. As before, the negative charged acid radical is attracted by the anode, and probably an insoluble aluminum salt is formed. But, according to Messrs. G. E. Bairsto and R. Mercer (Trans. Faraday Soc., Vol. 7), this is not the whole story. They claim this layer is a good conductor, and that the peculiar property of the aluminum anode is due to the formation of a thin gas layer, probably oxygen, possibly in the liquid state. This gas layer is in the order of 1×10^{-6} cms. thick, the thickness depending on the voltage but independent of the solution. The outer layer, of course, depends on the solution. It is likely that this outer layer protects the inner insulating layer.

Investigators found out that there existed an upper limit to the voltage, above which the current increased rapidly with increased voltage. This limit varies with different solutions, as is shown by the following table:—

Sodium Sulphate (Glauber's Salt)	40	volts.
Ammonia Hepta Molybdate $(NH_4)_6\ Mo_7\ O_{24}$,	245	"
Ammonium Bicarbonate, $NH_4\ HCO_3$	425	"
Ammonium Hydrogen Phosphate $(NH_4)_2\ HP\ O_4$	460	"
Ammonium Citrate	470	"
Borax	480	"

Since this insulating layer is formed only on that part of the electrode which is submerged, at the surface of the electrode there is a tendency for sparking to take place between the unprotected metal and the solution. This results in unnecessary heating of the solution, large leakage current with low efficiency, and corrosion of the aluminum. It is therefore of the utmost importance that the electrode be protected at this point. If a wire electrode is being used, a piece of glass tubing might be slipped over the wire and the space filled up with wax. Perhaps several thick coats of a water-proof varnish may be sufficient, or simply dipping in pitch or sealing wax. If a cylindrical electrode be used, a piece of tight-fitting rubber tubing may serve.

Unfortunately, this insulating layer that forms is not a perfect insulator, thus giving rise to the so called leakage current. The magnitude of this leakage current depends upon:—

1. The dissolved salt.
2. The temperature.*
3. Concentration of solution.
4. Purity of solution.
5. Length of time of formation.
6. Voltage of formation.

*Centigrade scale used throughout.

The effect of the first two, *i.e.*, the salt used and the temperature, is shown in Fig. 1. These curves show that at low temperatures ammonium tetraborate is the best salt. Ammonium Bicarbonate is very good, but at 55 degrees its behavior changes. At this temperature a solution of Ammonium Bicarbonate starts to effervesce, giving off carbon dioxide, forming ammonium carbonate.

$$2NH_4\ HCO_3 — (NH_4)_2\ CO_3 + CO_2 + H_2O.$$

Fig. 2 shows that at low temperatures the concentration has little effect. However, the saturated solution is seen to be the best.

The influence of impurity is clearly shown in Fig. 3.

The length of time taken to form the anode is seen to have a marked effect on the leakage current, as is shown in Fig. 4.

These temperature-leakage current curves follow a law of the form:—

$$\text{Log } i = \text{Log } A + a\theta.$$

This is nicely brought out in the curves in Fig. 5. This set of curves also shows that a decided advantage is to be gained by forming the anode at a higher voltage than that at which it is to be employed.

It is perhaps unnecessary to suggest that pure aluminum be used. I have been told by the Northern Aluminum Company that aluminum for electrical purposes (that is for conductors, etc.) can be obtained 99.5% pure, the impurities being silica and iron. This should be very satisfactory. Often after an aluminum electrode has been

used some time, brown or black spots appear. These spots are probably due to iron; they seem to be without effect on the electrical action. Wire seems to wear more evenly than plate, probably due to the altered crystaline structure of the latter.

The cathode should be free from metals which form a soluble salt with the acid radical, for when the aluminum is cathode, *i.e.*, the rectifier is passing current, these metals will dissolve, to be plated out later on the aluminum. This will certainly increase the leakage current. A good grade of lead (chemically speaking) may be used. If there be any doubt as to the purity of the lead, carbon should be used; the use of the latter is always to be preferred.

The solution should be made up of pure chemicals. The effect of various impurities has already been pointed out. If commercial borax is being employed, it will be far from pure. Purification may be performed by dissolving as much as possible in a little boiling water, filtering hot if necessary, to remove undissolved foreign matter, and then setting aside the solution to cool. Crystals of a borax of a high degree of purity will settle out, and should be collected. The mother liquor containing the dissolved impurities had better be discarded.

The solution must not be alkaline, as an alkali will attack the protecting covering provided by the aluminium compound formed around the aluminum anode. If the borax solution tests alkaline, phosphoric acid should be added till acid. Chromium salts, such as potassium bichromate, raise the critical voltage, particularly in the case of borax. The addition of phosphoric acid, and of bichromate will also improve the conductivity.

Ammonium phosphate is preferred by many, and may be prepared by neutralizing glacial or syrupy phosphoric acid with strong ammonia. It should not be alkaline. Sodium phosphate is of but little value. The ammonium phosphate solution is an excellent culture medium for micro-organisms, which, in time, will decompose the ammonium phosphate. To guard against this, it is better to add a little phenol (carbolic acid) to the ammonium phosphate solution. After a solution has been used some time, a white precipitate, an aluminium salt, settles out on the bottom. This should be removed before it reaches the plates.

The losses in the rectifier are due to three causes:—

1. Ohmic drop.
2. Leakage current.
3. Loss due to counter emf.

The first varies inversely as the area of plates; the second directly as the area of the aluminum plate.

It is a difficult matter to state what size plate should be used, as it depends on too many variables. It is, therefore, best found by experiment. I have been able to light a 40 watts lamp, apparently up to brilliancy, rectifying 115 volt a. c., with four jars, using a piece of No. 14 aluminum wire about 1¼ inches long. A current density of 1/10 amp. per square inch is good, but may go as high as two or three amps. Too high a current density is made apparent by brilliant scintillation on the aluminum. These scintillations are due to the break down of the gas film, with the consequent formation of a small arc. This results in a high leakage current and heating of the solution. A diffused glow is probably characteristic of a proper current density, while the absence of glow might be taken as an indication that the rectifier is not functioning. Brilliant scintillation will occur also when the critical voltage is approached.

While on the subject of the aluminum anode, I wish to say a few words about electrolytic condensers.

Consider the formed aluminum anode. We have here a metallic conductor separated from another conductor (the electrolyte) by a non-conducting film—in effect, a condenser.

Unlike other condensers, however, the capacity varies with the voltage, as Fig. 6 shows. The product of capacity and voltage drops off slightly with increased voltage, as the following table sets forth:—

Volts.	Cap. per Sq. Cm.	C. x E.
10	.81	8.1
20	.391	7.82
30	.251	7.53
40	.178	7.12
52	.135	7.02
50	.141	7.05
80	.087	6.94
119.5	.058	6.91

The capacity also decreases slightly with age. The higher the voltage, the longer the time till equilibrium is reached. The following table shows this:—

Capacity of Aluminum Anode Film. Concentrated Ammonium Tetra-Borate Soln. 15 Degrees

30 Volts

Hours	Cap. per Sq. Cm.
1	.305
4	.295
25	.255
45	.251
95	.251

90 Volts

Days	Cap. per Sq. Cm.
1	.091
2	.088
3	.087

The effect of temperature on the capacity is not the same in all solutions. In the case of ammonium tetra borate solution, the capacity increases with the temperature, and, moreover, on cooling down, some of this increased capacity persists.

Compare ammonium hydrogen phosphate solution. An increase of temperature causes a decrease of capacity. Cooling of the solution causes a further decrease in capacity. This is shown by the tables:—

Ammonium Tetra-Borate Soln. 125 Volts R.S.M.

Degrees	Cap. per Sq. Cm.
15	.051
31	.053
42	.054
61	.056
74	.0597
85	.0608
88	.071
90	.078
14	.064

Neutral Sodium Phosphate Soln. 29 Volts R.M.S.	
Degrees	Cap. per Sq. Cm.
18	.27
35	.271
50	.27
60	.266
70	.260
73	.256
76	.254
18	.222

The influence of various factors on the leakage current, as already pointed out, is much more marked here, as usually the area of aluminum exposed is larger, in order to obtain the capacity.

It would be well to emphasize the importance of keeping the resistance of the electrolyte and cathode system down to a minimum, as resistance here will cause an i. r. drop when the condenser discharges. This resistance will be lowered by providing a generous cathode, placed as close to the aluminum anode as possible.

To sum up, ammonium tetra-borate, or perhaps plain borax, appears to be the best salt. Use the best aluminum for anode. Insulate it carefully where it leaves the solution. Choose a good grade of material for cathode, preferably carbon. Tap water may be used, but, as it contains both chlorine ion and NO_3 ion, loss from evaporation should be compensated for by distilled water, otherwise the amount of these impurities will steadily rise. A layer of coal oil will prevent evaporation. Make sure of saturation by having an excess of undissolved salt present. Have a generous quantity of electrolyte, to keep temperature down. Provide for natural circulation of electrolyte by placing the electrodes as close to the bottom as possible. Cut down the amount of heat generated by keeping electrodes close together. If possible, form the anode at a higher voltage than that at which you will use it. The plates can be satisfactorily formed with a. c., using a voltage of from 250 to 500 volts. Don't discard an old anode, as they improve with use. When deciding on the number of jars to be used in series, remember that the maximum voltage, which is the voltage the film has to withstand, is somewhat higher than the R.M.S. value indicated by an a. c. voltmeter. One hundred and fifty to two hundred volts per cell is about correct.

In conclusion, I wish to point out that none of this work is original, but is a synopsis of a paper by Messrs. G. E. Bairsto and R. Mercer, appearing in Vol. 7, 1912, of Trans. Faraday Soc., and another paper by Mr. Bairsto, in Vol. 8, 1913, of the same journal. Many very pertinent remarks made by Mr. Middleton in a discussion of the subject at the Radio Research Club of Canada are also included. I wish to acknowledge my great indebtedness to Prof. Burt-Gerrans and Prof. Bain of the University of Toronto for excellent references supplied by the former gentleman, and for the use of the latter gentleman's extensive library.

KDKA

It seized Jove's lightnings from on high
And them forthwith to us did ply,
To cheer the sad and speed the gay:
A magic witch,—K D K A.

It brought the church to lame and sick,
The current news—correct and quick—
Musician's art and actor's play—
A Hermes real,—K D K A.

To men of world, the market gage,—
The measured words of learned sage.
To sports, their contests, play by play:
An oracle,—K D K A.

Again, to kiddies, Christmas cheer, —
The bedtime yarns of Wiggily's ear.
Delight and joy for them each day:
A Santa Clause,—K D K A.

To science's serf, a source of joy,
The same to every radio boy,
To try the stunt, to blaze the way:
A pioneer,—K D K A.

E'en to gay youth, who pleasure has
To trip the dance, it brings the jazz.
No crank to wind, nor fiddler pay:
A jolly sort,—K D K A.

And when kind deeds of earth are writ,
And angel courts in judgment sit,
As in Abou Ben Adhem's day,
They'll write it high,—K D K A.

AUSTRALIA'S GREATEST NEED

A high-power wireless station similar to the New York Radio Central, that will enable direct world-wide communication with all countries is unquestionably Australia's greatest need. We are isolated more so than any other continent, especially in respect to communication. If the cables break, communication is severed until repairs are effected—in the meantime all messages are held up. Another disadvantage of the cable is the fact that messages have to be relayed so many times.—*Sea, Land and Air.*

Twenty years ago a miracle was performed. Marconi dispatched his immortal message across the Atlantic without a connecting wire. To-day, after twenty years of more or less languid interest, the whole world has taken up the art and by popularizing it have created a veritable "gold rush," a condition that is without precedent and a demand for radio equipment that the great manufacturing plants have been unable to meet. It extends from the arctic to the tropic, from the Fifth avenue residence to the slums, from the busy man's office to the farm. Radio is king.

Henry Ford is going to tell "flivver" owners of the intricate methods of "flivver" operation by wireless 'phone. The department of commerce has announced that Ford has been granted permission to operate a broadcasting wireless 'phone at Dearborn, Michigan. His call is WWI.

RADIO EVERYWHERE

A receiving station has been established in the Grand Central Hotel, St. Catharines, Ontario, which claims to be the first hotel in Canada to supply radio music to their guests in place of the old-fashioned orchestra.

Hereward Corrington will try to communicate with the "spirits" by means of radio. A large laboratory is now being equipped with special apparatus developed by Thomas A. Edison. The spirits that are expected to respond are Mr. Carrington, Enrico Caruso, Janet Beecher and Bill Shakespeare himself. No information has been given as to how the spirits will be informed of the correct wave length to tune in on for these earthly messages.

Mayor James L. Key, first southern mayor to deliver an address by radio, spoke a message recently at The Atlanta Journal's Radio station, WSB, in behalf of Henry Ford's plans for the development of Music Shoals.

Toronto city enjoys the unique distinction of being the first in the records of history to use the radiophone to broadcast its propaganda. The occasion for the experiment was during the course of the radio concert which the Toronto Star gave on April 7th, when Robert M. Yeomans, acting secretary of the Toronto Publicity Bureau, gave to an audience scattered over something more than 3,000 square miles a five-minute discourse upon the manifold attractions of the city.

The Bell telephone system is planning a commercial radio telephone service station in each of the large cities of the United States for use in long distance telephony. They will be connected with the wire telephone system so that calls may be made from any point in the vicinity of each station.

Few men have had the unique experience of Mr. Walter Seldon, Toronto. Nearly half a century ago he heard the strains of a violin come over Alexander Graham Bell's first crude telephone. Recently, in the Masonic Temple, Toronto, at the Toronto Star's first radio concert, he heard music coming miles through the air without wires.

Mr. Seldon was a Grand Trunk operator at Caledonia in 1876 when Graham Bell was making, at Brantford, 22 miles away, the experiments that gave the telephone to the world. The inventor used the railroad telegraph wire for transmission. They tried to transmit violin sounds three nights a week for a month before they succeeded.

Radio Parties the Newest Fad.—Among all ages, the most sought for invitation is that which reads "Come Take a Trip Through Radioland." Truly the owner of a radio outfit is the most popular man of the day.

Wireless concerts have been recognized as a therapeutic agent by the Detroit Tuberculosis Sanatorium, which soon will install a complete radio receiving set in its auditorium, 80 by 40 feet in size. Four hundred patients will be enabled to hear the music and other entertainment broadcasted by large stations.

A movement for mobilizing every civic, commercial, industrial and agricultural interest in Georgia in behalf of development of Georgia products was launched by the Georgia Federation of Women's Clubs Wednesday when proclamation by Governor Thomas W. Hardwick, designating the week of May 22 as "Made in Georgia Week" was broadcasted over The Atlanta Journal's powerful radio station.

Plans are under consideration to equip the Winnipeg police force with radiophone receiving apparatus, and if this method of sending instructions to members of the force proves satisfactory it may be inaugurated by the Manitoba provincial police force.

"In ten years every home will be able to tune in on universal lectures, as well as on music," says a noted engineer.

It is estimated there are now 6,000,000 persons "listening in" to radio programmes every night on this continent.

The Radio Corporation of America intends to open a big broadcasting station in New York City, to replace the one closed down at Roselle Park, N.J., in February.

Radio for traffic control is the latest. It was used recently at Croydon, England, on the occasion of the aerial derby. Orders were relayed by wireless from a dirigible to the controlling stations on the ground.

Recognizing the educational value of the radiophone when it is used for broadcasting concerts by distinguished musicians and instructive talks on subjects of general interest, several schools in Georgia are considering the advisability of installing radio receiving sets in their main auditoriums as a feature of their scholastic courses.

Courtesy Industrial Digest.

The Finger on the Pulse of the World. The Smallest Radio Receiving Set Yet Made.

A Philadelphia builder announces that he will build $1,000,000 worth of high class apartment houses and will equip each apartment with a radio telephone. Which will be a great improvement over the old party line or dumbwaiter source of information.

Nearly every fire department company in Union County, New Jersey, now has a radio receiving set.

The city of McRae, Georgia, is planning to equip a radio station to serve the community by giving the residents of the town an opportunity to listen in nightly on the entertainments now being broadcasted.

The radio has cut in on the profits from phonograph records and sheet music. Less of this source of music is being bought today, says William Rossiter, music publisher, because thousands of fans are depending on the radio concerts for their amusement.

Brenau college in Georgia is probably the first institution of the South to take advantage of wireless for broacasting its entertainments, as it was also first to install a moving picture machine for the entertainment of its students.

A wireless news service has been planned by the Harvard Wireless Club. An effort will be made to co-operate with other colleges in broadcasting inter-collegiate news of interest to the students and alumni. The club is equipped with a set that will transmit 500 miles and receive any station east of the Mississippi.

The railroad agent at Port Jervis was approached by a badly scared man who complained that he had a "hat full of radio waves" and did not know what to do with them. The police department was called and when he had properly insulated the complainant a pair of keepers from the nearby hospital for the insane accompanied their charge back to his "radio wave-proof castle."

A short elementary correspondence-study course on radio telephone reception is now under preparation by the university extension division of the University of Wisconsin, located at Madison, Wis.

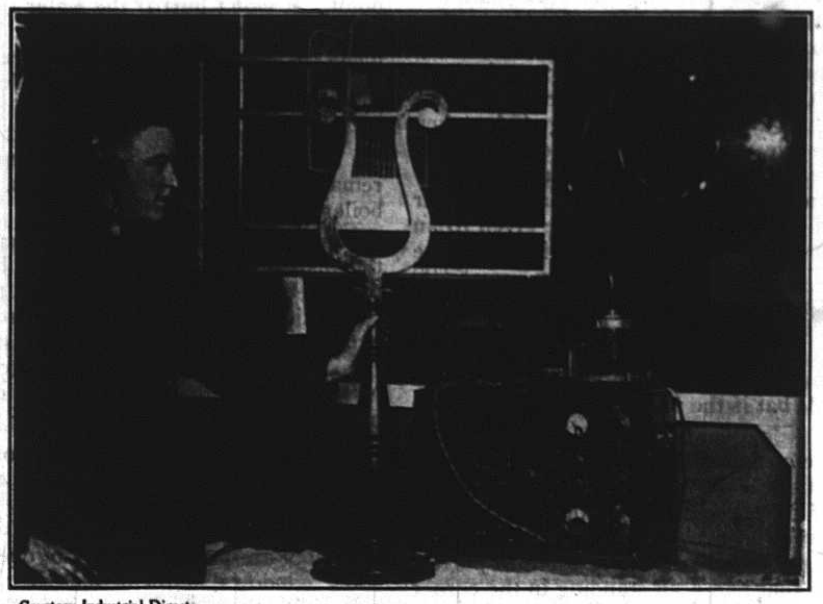
The "radio bug" has been doing some biting in the Michigan state prison at Jackson. Seventeen hundred men there will soon listen to the "music in the air." A loud talking receiving set is being installed in the recreation room.

Paris now tells the time by wireless. Fifteen hundred small wireless outfits have been installed in Paris jewelry, watch and clock stores to enable the jewelers to catch the correct Greenwich meridian time as it is sent daily at 10 o'clock by the Eiffel tower. Formerly the exact time had to be obtained from the Eiffel observatory by telephone.

A demonstration was given before a group of physicians in the Signal Corps laboratories at Washington recently. A heart transmitter designed especially for this occasion was placed over the heart of the patient under examination. The passage of blood through the various valves of the heart set up vibrations in an air chamber of the instrument. These vibrations were led to an amplifying device consisting of a group of standard vacuum tubes. The vacuum tubes when amplified actuated a special receiving instrument to which was attached a supersensitive loud speaker, which delivered sounds created by the heart to the listening audience. Several subjects suffering from various heart diseases were examined for the edification of the doctors attending this novel performance.

Later experiments along the same lines have proved that these sounds can be transmitted by wireless over great distances. This means that in the future heart specialists living miles away can diagnose and prescribe for patients whom they never see.

Now that so many pastors are delivering their sermons to the stay-at-home via radio, will it not ultimately be probable that the sermons may be picked up at every home, or while motoring, or even while at the club or on the links? This is possible with equipment now in use. Then, perhaps, the minister will be able to deliver his sermon right from his own comfortable rooms, or even he too, might broadcast from an auto. The problem that must be solved, however, is just how to get that plate all the way round.



Courtesy Industrial Digest.

The Modern Lyre, the Latest in Antennae which Brings the Radio Message into the Parlor without Aid of Outside Wires.

Soviet Russia will soon have a wireless station capable of transatlantic service, says H. Nikolaieff, assistant commissar for Posts and Telegraphs.

One crowd that does not like radio-phones—Mexican revolutionists! In the old days rebels started activity by cutting down telegraph wires and paralyzing communication. Now the Mexican government is planning to install an elaborate radio system with government stations in all big cities. Meanwhile President Obregon is whiling away the time with his own private set.

Probable news item, 1950:—To avoid interference, the government has permitted a special wave length for business men 'phoning home at six oclock that they will be busy at the office.—*Toronto Star.*

Radio seems to have a niche reserved for it in every line of endeavor known to mankind. Experiments are now being performed with the view to using the radiophone on patients undergoing operations.

Posing as police inspectors of wireless equipment operated by amateurs in Winnipeg, several men, believed by police to be housebreakers, are obtaining entrance to homes in all parts of the city for the probable purpose of learning their way about the houses for later robberies according to a statement by Chief Constable C. H. Newton.

So many radiophone outfits have been installed in New York houses, that the bureau of surveys of the New York board of fire underwriters has found it necessary to issue a memorandum of requirements on radio installation.

Radio was employed a couple of weeks ago to send out an alarm for a boy who disappeared from his home at Rutherford, N.J.

For the first time in more than seven years, Mrs. James L Hay of Detroit heard music. This was due to the aid of a radiophone. Although Mrs. Hay and her relatives had tried every means known to them in an effort for her to hear, all had failed until her son, who had set up a radio receiving outfit, placed the receivers to her ears.

Solving The Amateur's Storage Battery Problems

Every modern amateur is turning to the use of triode receivers, and one of the problems that confronts the proud possessor of a brand new Radiatron valve is how to heat the filament. Dry cells are hooked up and the thrilling moment arrives when signals begin to come in. But, as every amateur knows, dry cells are simply N G (and then some) for filament heating. Reluctantly, the amateur hunts through the worn linings of his pocket-book in the hope that he may find the odd 20 or 30 dollars for a 6-volt storage battery. For a 6-volt storage battery it *must* be.

Now, Mr. Amateur, why pay $30.00 odd for a storage battery when you can get one for, say, $3.00? The writer has never bought a new storage battery in his life, and there are three perfectly good sets of cells in the wireless room here now, and perhaps we have had as many as a dozen sets at one time or another. Where did they come from? No, we didn't steal them. In most cases a battery repair man or car owner *gave* them to us.

The "mortality" of automobile starting batteries is appalling. I write the second word of the last sentence in italics, because in most cases the so-called "dead" batteries are not half as dead as they look. Mr. Car Owner has been banging the poor old battery about, and has simply knocked it unconscious. When the garage or service man says it wont come to, the car owner concludes his battery *is* dead, and throws it in a corner of his garage to be taken out and carried away by the garbage man on May-day. This is the radio amateur's opportunity. Such a battery can be procured for nothing, or at most for maybe a dollar or two. A word of warning here should be given to an amateur who gets a battery in this way: If he gets the thing gratis, that's all right; but if he must pay—say $2.00 for it, that's a different matter. Don't *buy* an old battery until the following facts are known: How long has it been in use? Has it ever been "taken down" at a service station? Does the owner of the car on which it was used go on long drives? What is the name of the maker of the battery?

I will discuss these questions in order. First, a battery that has been in continuous service for more than 3 years prior to the time of its "decease" is a doubtful proposition. It does not matter how many years the battery may have been lying in a corner. We once restored to perfect health an old battery that had been standing in the corner of a garage, forgotten, for nine years! The "acid" in this old-timer was so weak it would not discolor blue litmus paper.

The second question is an important one. Don't *buy* a battery that has once been in the hands of a battery repair man. Very few battery "repair" men know anything at all about storage batteries beyond the simple rules applicable to charging and connecting up the cells.

Question No. 3 is important also. Most cars nowadays have their generators set for too high a charging rate. For city driving with its frequent calls on the battery for starting purposes, a high rate of charge is perhaps permissible; but on long runs in the country, a high sustained charge tends to buckle the plates of the battery and loosen the active material. A battery in this condition can be repaired but will likely have only a small part of its original ampere-hour capacity. Avoid such batteries if possible.

Who makes the battery?" I will not mention some makes here. It would not do. Some manufacturers produce a cell that our friend 3DO would probably refer to as "garbage."

Now, to begin with, it doesn't matter in what condition the cells are as to gravity or voltage. We want to have a good reliable battery when we are through, but there is some work ahead of us before our old-timer will have recovered his "kick." We cannot always restore a battery to full 100% capacity, but most will come back to 75 or 80%, and that is all the amateur needs for a filament heating battery. We could write several pages of matter on the chemistry of batteries to prove theoretically why such cells can be restored cheaply, but let us stick to the practical side of it.

First, dump out all the acid from the cells. Pour in *ordinary* water; rinse out, and repeat the process twice. *Invert* the cells, box and all, in mother's wash-boiler (it won't hurt it if cleaned carefully afterward with lye or baking soda). Pour into the boiler enough water to almost cover the battery. Set the boiler, with battery in it, on the stove and heat until the water is just below boiling point. It won't hurt if the water does boil, but result can be obtained without waiting that long. The hot water melts the black compound on the cells and the box can be pulled off. Lay the box to one side, and pull off the rubber jars, one at a time. Clean the jars thoroughly, not forgetting the sediment troughs at their bottoms. Take the boiler out into the back yard and dump out water and remains of battery onto the grass. Now clean mother's boiler, as we won't need it again.

Proceed to remove the wooden separators from between the plates. *Don't cut the straps* between the cells; the three cells can be handled as a unit without breaking the connections. Now get out the garden hose and flush the plates thoroughly with a moderate stream of water. Turn the stream down between the plates and flush away any active material that may be loose on the plates: It will only give trouble later, so don't try to save it.

If there is an excessive amount of white sulphate warts on any of the plates, scrape them off. Get the plates all clean. Don't worry if a few of the plates have some empty grids showing. The end-positives (the brick colored plates are positive, the gray ones negative) may have some windows in them, but as long as half the active material is there the battery is forth repairing.

Now examine the separators. If they are covered with white blotches, throw them away and get new ones. They cost about 3 cents each. Just throw away the bad ones. If they can be cleaned with a brush, keep them. If the separators are of perforated rubber, try to clean them, as they are good indefinitely if you can get them cleaned successfully. If separators are of the thread-rubber variety, throw them away and get wooden ones. Don't use rubber separators in which fabric threads are moulded. The acid soon reduces the celulose fibres and destroys the usefulness of the separator. Now for replacing the separators: Make sure that the ribbed side of the separator *faces* the positive plate, in all cases.

Shove the jars back over the plate assemblies. If the jars refuse to slide back on easily, *don't force them*, but set the jars in boiling water, and while hot, and hence soft, they may be forced on into place. Put the assembled cells into their wooden box and melt in the rubber compound

with a torch or hot iron. If some of the compound has been lost, more may be obtained cheaply at a service station. Don't substitute tar. That's not what they use.

If using an open flame near a storage cell, be sure that the caps or vent plugs are *opened*.

Procure a solution of sulphuric acid having a specific gravity of 1.3 ("thirteen hundred," the garage man calls it), and fill the cells up to a point ½-inch above the tops of the plates. If you want to know how much acid solution to buy, fill your cells with water and allowing bubbles to settle the level of the liquid at the required point, pour off into a vessel. The amount of water in your vessel will represent the volume of acid needed.

If the garage man has no acid of 1.3 gravity, or wants too much for his precious stuff, make it up. Go to the drug store and get enough chemically pure sulphuric acid to do the job. How much? Well, drug store acid (C.P.) has a gravity of 1.8. That means .5 difference from what you want. Distilled water has a gravity of 1.0. You must therefore raise the water-gravity .3 with a liquid that has a difference of .8. We have found that for a 90 ampere hour Exide battery about 3 pounds of drug-store acid is necessary. This costs about $1.00 in Toronto stores.

When making up acid solution considerable heat is developed, and the acid should be added to the water *very slowly*. Never try to pour the water into the acid. Pour the acid *slowly* into the water. Use glass vessels.

After the cells have been filled with solution, let them stand for an hour or so. Test them with a hydrometer and you will find that the gravity has dropped to perhaps as low as 1.150. The cells should be put on charge at from 6 to 8 amperes. In about 12 hours the gravity will have risen again to 1.3 and the battery is now ready for use.

This battery should last for several years, if properly cared for. One device that every battery owner should have is a hydrometer. It consists of a heavy glass tube with a rubber bulb at one end and a rubber hose at the other. Inside the tube is another piece of glassware carrying a printed scale and weighted at one end. The latter affair is really the hydrometer, and when solution is sucked up out of the battery into the outer tube, the hydrometer will float at a certain level, depending upon the condition of the solution. The "specific gravity" should be read at the point where the surface of the liquid lines up on the scale of the hydrometer. The hydrometer test shows the true condition of a battery more accurately than does any other single method of testing. A fully charged battery will read anywhere from "1280" to "1300." When the hydrometer gives a reading of "1160" or less, the cells should be put on charge.

Watch the electrolyte, or solution, in your battery. It evaporates slowly, and pure distilled water should be added from time to time to compensate for this evaporation.

Storage batteries are a matter of awe and mystery to the average person who has never played with them. Somebody once told a man that if his battery ever went dead, that was the end of it. "Service station" men thought it was good for business, and they have told the yarn so often that most of them believe it themselves now. I can state, from my own experience with a large number of "dead" batteries, that all most of them need is a good cleaning up and a fresh acid solution. It's a nice job for a Saturday afternoon, Mr. Amateur, and it will save you about $25.00. Try it!

The United States army is saving large sums of money by using radio instead of telegrams in communication between headquarters and posts.

WHEN RADIO LINE IS BUSY DON'T JIGGLE THE ANTENNA POLE

Speak directly into the broadcaster.

If you have trouble getting your party do not jiggle the antennae; shake the aerial pole or hammer on the roof.

Be courteous over the radiophone. Do not shout: "Get off the ozone!" "Aw, hang up!" "This is a private wave length!" or other vulgar commands.

Never lose your patience to the point of yelling. Remember, after a hard day's work the little nitrogen and oxygen units become very exhausted and nervous.

To correct lack of attention on the part of the atmosphere complaint operators will be maintained in blimps over all larger cities.

Never ask for "information." Just listen long enough and you'll get both ears full.

To get a policeman, say "I want a policeman." How many policemen you get will depend upon your wave length.

To report a fire, say "I wish to report a fire." In case you have a fire just at the time the "Man in the Moon" stories are being broadcasted you will have to wait until they are finished. The management will send subscribers a booklet on "How to Keep Fires Going Until an Opportunity Comes to Report Them" on request.

After reporting a fire by radiophone you should get responses or regrets from firemen all over the United States.

In case of sickness say "I wish to report a case of 'Spanish influenza.'" In a few moments you will be assigned a place in the broadcasting programme immediately after the "zither solo by Aletia Dudd" and the "weather report from Arlington."

Subscribers will please excuse slight errors in establishing connections on the radiophone. If you ask for "Saxaphone Selection by J. Goofus Zuff" and get a "Fashion Talk by Arabella McNally," kindly "excuse it, please." Likewise, if you call for "Address on the Darwinian Theory by Professor Duncan Dodobird" and are looped up with the Man in the Moon, you will please hang up, call the complaint operator and say in a courteous voice, "I got the wrong annoyance."

Subscribers must not swear through the air. It is likely to singe the feathers of birds in flight.—*H. I. Phillips in the Philadelphia Inquirer.*

BROADCASTING NEWS

"And the night shall be filled with music,
And the cares that infest the day
Shall fold their tents, like the Arabs,
And as silently steal away."

—Longfellow.

ADVERTISING VALUE OF RADIO TO THEATRICAL STARS

Inquiry among the artists who have actually performed for the radiophone audience shows an overwhelming majority in favor of radio as the most effective means of publicity ever made available to theatrical talent, and this is because there is a vast quantity of positive proof in the hands of the performers that "appearances" by radio boost the box office receipts rather than lessen them.

When persons go to the theatre they view an artist in a new light because of the intimate "contact" established by radio in bringing the performer's talents into the sanctity of the listener's home. The box office value of this friendly basis, which radio establishes, needs no comment. Personal popularity is the actor's greatest asset, and radio is a friend-maker.

Talented performers "go over big" by radio-phone because of the mental attitude of the listener, who at home, comfortable in receptive mood because of the informality of the surroundings and flattered by the undoubted sensation which radio gives the listener—that of being the sole listener.

Considering that the radiophone brings and concentrates the attention of 500,000 people at one instant upon the ability of a performer, leaving no permanent record of the actual selection sung or played or the words spoken, but does pick out and make distinctive the personality of the artists, it can be safely wagered that radio has no peer as a publicity medium for the theatrical profession.

If there is any lingering doubt in the minds of the parties concerned, let them reflect upon the early alarms over the phonograph. Radio goes the phonograph one better, because no permanent record remains—unsatisfied desire again! That is what will bring the public to the theatre to hear and see in full what they have enjoyed over the radiophone. This is not theory, for letters written by listeners run into the millions, and the writer has seen thousands that definitely state that the radiophone has created a desire to see the performers in person.

The head of a certain large vaudeville circuit in a published interview is quoted as asking how the newspapers would feel if news was sent into the home free of charge? For his special benefit we refer him to the first feature of the daily programme of the New York Metropolitan district, which is an hourly summary of the news of the world, with particular stress being laid on the local news. The Newark Sunday Call says authoritively that it has helped circulation wonderfully.

The radiophone broadcasting is a medium that any educator or entertainer of the public is fortunate to have the opportunity to use and they should be thankful that no charge has been made upon them for giving them a chance to get to the inhabitants of radioland.

TORONTO STAR NOW BROADCASTING

On March 28th the Toronto Daily Star entered the broadcasting field. On that occasion it gave what is probably the first radio concert of its kind. Pending the completion of its own station, use was made of the Canadian Independent Telephone Company Station for the actual broadcasting. But, in addition, a large auditorium was rented by this progressive newspaper, and therein was installed a very complete receiving set and loud speaker. Needless to say, there was a capacity attendance. The programme, which was of a high order, was thoroughly enjoyed. This programme, which is given below, was to many listeners their first experience with this new wonder we call "Radio," and in years to come will, no doubt, often be called to mind.

Following this concert, a number of others were given at intervals, until now, at time of writing, a daily schedule has been put into force.

The Star secured the first broadcasting license granted a newspaper in Ontario. Particulars as to this will be found in another column.

When their new station is completed they will use two kilowatts, and expect a range of at least 600 miles. At present, with the use of one-half kilowatt, they anticipated a range of only 150 miles, but reports have been coming in from over 400 miles distant.

RADIO VS. AUDIO FREQUENCY AMPLIFICATION

More and more attenton is being paid to radio frequency amplification, although audio frequency continues to predominate. The difference between these two methods is that radio frequency amplification consists of building up the intercepted radio energy before impressing it on the detector, which in turn makes this energy capable of actuating a telephone or other device. Audio frequency, on the other hand, is used to build up the audible frequency current issuing from the detector. Now, in that many types of detectors only begin to function when the intercepted wave strength has reached a critical point, it stands to reason that very weak waves will not be detected, and no amount of audio frequency amplification can help matters, since there is nothing to amplify. On the other hand, even with extremely weak signals it becomes possible to pass them through one or more radio-frequency amplifiers to be built up before being introduced to the detector. Then, if desired, the output of the detector can be passed through several stages of amplification, so as to obtain maximum audibility.—*Scientific American.*

In spite of the fact that radio fans have been assured that low resistance receivers will not work for radio reception, the telephone companies have begun to worry about the theft of receivers from pay stations. Detectives are on the path of the "phone pirates."

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Evelyn Chelew Kemp, Pianist.

Boris Hambourg, 'Cellist.

Mrs. R. J. Dilworth, Soprano.

Toronto Stars' First Radio Program

MARCH 28, 1922

1. God Save the King.
2. Mrs. R. J. Dilworth, Soprano.
   (a) "Down in the Forest" ..... Landon Ronald
   (b) "Annie Laurie."
3. Evelyn Chelew Kemp, Pianist.
   (a) "Sprites of the Glen" ..... Dennee
   (b) Arensky's "Etude."
4. Victor Edmunds, Tenor.
   (a) "The Dawn" ..... Pearl Curran
   (b) "The Elegie" ..... Massenet
5. Romanelli's Orchestra.
   Popular Medley of Syncopated Harmony:
   "The Sheikh; Oh Me, Oh My! Sweet Hortense; Wabash Blues; Say It with Music; If Winter Comes; Moonlight Serenade."
6. Boris Hambourg, 'Cellist.
   "The Swan" ..... Saint-Saens
7. Alberto Guerrero, Pianist.
   "Study in Waltz Form" ..... Liszt
8. Henri Czaplinski, Violinist.
   "Gipsy Airs" ..... Sarasate

Victor Edmunds, Tenor.

Alberto Guerrero, Pianist.

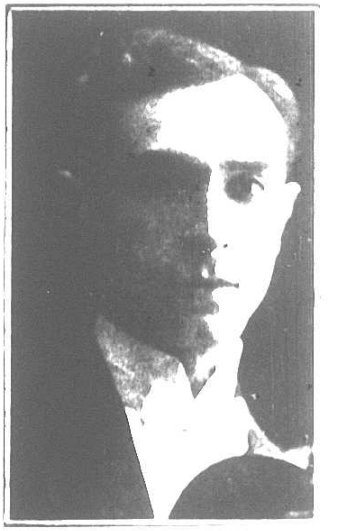
Henri Czaplinski, Violinist.

Evelyn Chesew Kemp, Pianist

Toronto Stars' First Radio Program

MARCH 28th 1922

Victor Edmunds, Tenor



Broadcasting and Legislation

Since our last issue went to press, Radio broadcasting secured its real foothold in Canada when the Toronto Daily Star began its daily schedule from Radio CKCE. We have arrived! And the Daily Star is to be felicitated upon its foresight and enterprise. More power to you, gentlemen!

Broadcasting has brought to Canadian Legislators a new problem. "The old order changeth" in more ways than one. New conditions prevail, and a means must be provided for meeting them. A few months ago the stilly(?) night was freely punctured by the shrill raspings of a hundred "squeak-boxes" in the hands of certain ambitious youngsters of scientific bent; to-day the thousands of new "amateurs" who want to listen to the broadcasting stations ask, "What are these noises? Why are these childish people allowed to spoil our nice concerts? Is the Government asleep? Why don't they DO SOMETHING?!!!"

We put it up to Naval Ottawa long ago. But they said, What can we do? If we restrict the amateurs we will require an army of inspectors to enforce the law. One spark transmitter can spoil a whole concert, but what can we do with him? We call him down, and he whimpers and says the air is free. Has he no rights? Who has the rights anyway? If we confine his activities to hours when no broadcasting is in process, it will require men with Federal authority to keep him in his place. There was a time when it was thought that all radio amateurs were gentlemen—that they could regulate themselves; but evidently there are a small group that will not only *not* regulate themselves but will not be regulated at all by anybody short of a Federal officer of the Law. If we make laws we obligate ourselves to enforce them, and no money appropriations have been made for this purpose.

The game has gone ahead so rapidly that sleepy Ottawa has not yet caught up with the progress made, and the Naval Department must bide its time, while the public becomes more and more enraged by the specific outlawry of certain radio "amateurs." It is bound to end, and we think the end is near. An outraged public will soon learn to use the power that was given to it by Confederation, and by the Act of 1867, and if Government financiers cannot make proper laws and proper law enforcement possible, then the people will show them how to do it. It's coming—very soon.

Not that we would see the radio amateur of the old school put down. He is too valuable an asset to the country. Let us not make the mistake of closing up the amateur transmitter, but rather get after the type of amateur who does no real work for amateur radio nor will he let others do any. It is the "dog-in-the-manger" type of amateur who is hurting the game and endangering the whole structure of amateur message relaying as built up by the A.R.R.L. and similar organizations.

The present trouble between relay amateurs and the broadcasting stations seems to be a too close grouping of the two bands of wavelengths. Our wave lengths are all wrong, we think. Amateur relay men use waves around 200 metres with the Americans up on 250 and 325 metres. This is getting rather close to broadcasting waves of 360 and 450 metres, particularly if the Government is going to allow the broad-tuning and old-fashioned "spark" method of telegraphy to flourish as of old. The newer continuous wave (C.W.) method of telegraphy permits much closer grouping of waves without interference, but it is still legal to use the "spark" method, and the Navy Department refuses at present to consider any prohibition of this older method among amateur stations. A prohibition of "spark" telegraph systems would solve the interference problems on the broadcasting waves. This will come, but meanwhile we must find another way of getting around the interference problem.

There is but one other way. Either the relay man or the broadcaster must take to the longer waves; so get a greater separation between the two wave-bands.

For reasons that are too long to discuss here, it would be unfair to put the relay worker on the longer waves available.

But the broadcasting station could work perfectly on a wave of say, 1200 to 1400 metres. This would clear away the interference by amateurs and give a band of waves that would miss most of the interference possible from a certain few navy and special commercial stations who might themselves well be shifted to the 2,000 metre wave band, anyway.

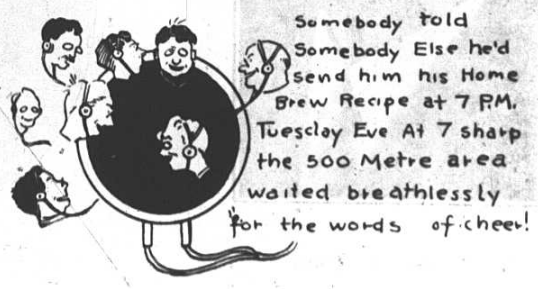
There is a very special reason why broadcasting stations would give better service on long wave lengths. That is, apart altogether from the problem of interference.

The new class of amateurs that already vastly outstretches the relay worker in numbers, consists mostly of people who are very inexpert in the art of "tuning" a receiver to "catch" on a certain wave. Now the *shorter* the wave the *harder* it is for *anybody* to tune to it. Hence the *long* waves can be more easily "tuned in" by the novice.

Long waves, however, again, invite trouble from interference of one broadcasting station with another. The tuning being broader on the longer waves, broadcasting stations that wish to work in the vicinity of one another simultaneously, must have waves differing by at least 100 metres; whereas on the shorter waves a difference of 5 or 10 metres is ample.

All these conditions must be balanced against each other and against others that arise from the existence of conflicting international agreements, and a working solution found. This is the problem that faces our radio legislators. We hope they are really busy trying to solve it, and we wish them good luck and *speed!*

Indications are that radio receiving and sending will be combined into one operation within a short time. The recent telephone conversation from an ordinary wire telephone to the steamship America at sea included use of a duplex telephone by which the speaker was also listener, without the necessity of turning the switch continually from sending to receiving.



U.S. CHAMBER OF COMMERCE ISSUES OFFICIAL BROADCASTING ROSTER

Owner.	*Location.*	*Call Symbol.*
Allen, Preston D.,	Oakland, Cal.	K Z M
American Radio and Research Corporation,	Medford Hillside, Mass.	W G I
Atlantic Pacific Radio Supplies Co.,	Oakland, Cal.	K Z Y
Atlanta Journal,	Atlanta, Ga.	W S B
Bamberger, L. & Co.,	Newark, N.J.	W O R
Bible Institute,	Los Angeles, Cal.	K J S
Carter Electric Co.,	Atlanta, Ga.	4-C D
Church of the Covenant,	Washington, D.C.	W D M
City of Chicago,	Chicago, Ill.	W B U
Cox, Warren B.,	Cleveland, O.	W H K
Crosley Manufacturing Co.,	Cincinnati, O.	W L W
DeForest Radio Telephone & Telegraph Co.,	New York, N.Y.	W J X
*Detroit News, The,	Detroit, Mich.	W W J
Doubleday-Hill Electric Co.,	Pittsburgh, Pa.	K Q V
Doron Brothers Electric Co.,	Hamilton, O.	W R K
Duck Co., Wm. B.,	Toledo, O.	W H U
Dunn & Co., J. J.,	Pasadena, Cal.	K L B
Electric Lighting & Supply Co.,	Hollywood, Cal.	K G C
Examiner Printing Co., The,	San Francisco, Cal.	K U O
General Electric Co.,	Schenectady, N.Y.	W G Y
Gilbert Co., A. C.,	New Haven, Conn.	W C J
Gould, C. O.,	Stockton, Cal.	K J Q
Hamilton Manufacturing Co.,	Indianapolis, Ind.	W L K
Hatfield Electric Co.,	Indianapolis, Ind.	W O H
Herrold, Chas. D.,	San Jose, Cal.	K Q W
Hobrecht, J. C.,	Sacramento, Cal.	K V Q
Howlett, Thos. F. J.,	Philadelphia, Pa.	W G L
*Karlowa Radio Co.,	Rock Island, Ill.	W O C
Kennedy, Colin B. Co.,	Los Altos, Cal.	K L P
Kluge, Arno A.,	Los Angeles, Cal.	K Q L
Kraft, Vincent I.,	Seattle, Wash.	K J R
Lorden, Edwin L.,	San Francisco, Cal.	K G B
*Marshall-Gerken Co.,	Toledo, O.	W S Z
May Co., W. D.,	Newark, N.J.	W B S
*Metropolitan Utilities District,	Omaha, Neb.	W O U
Meyberg Co., Leo J.,	San Francisco, Cal.	K D N
Meyberg Co., Leo J.,	Los Angeles, Cal.	K Y J
*Missouri State Marketing Bureau,	Jefferson City, Mo.	W O S
*Montgomery Light & Water Power Co.,	Montgomery, Ala.	W G H
Newspaper Printing Co.,	Pittsburgh, Pa.	W P B
Northern Radio & Electric Co.,	Seattle, Wash.	K F C
*Palladium Printing Co.,	Richmond, Ind.	W O Z
Pine Bluff Co., The	Pine Bluff, Ark.	W O K
Police Department,	Dallas, Texas	W R R
Pomona Fixture & Wiring Co.,	Pomona, Cal.	K G F
Portable Wireless Telephone Co.,	Stockton, Cal.	K W G
*Precision Equipment Co.,	Cincinnati, O.	W M H
Precision Shop, The	Gridley, Cal.	K F U
Radio Construction & Electric Co.,	Washington, D.C.	W D W
Radio Shop, The	Sunnyvale, Cal.	K J J
Radio Telephone Shop, The	San Francisco, Cal.	K Y Y
*Reynolds Radio Co.,	Denver, Col.	K I Z
*Rike Kumler Co., The,	Dayton, O.	W F O
*Rochester Times Union,	Rochester, N.Y.	W H Q
Seeley, Stuart W.,	East Lansing, Mich.	W H W
Service Radio Equipment Co.,	Toledo, O.	W J K
Ship Owners' Radio Service,	New York, N.Y.	W D T
Tuska Co., C. D.,	Hartford, Conn.	W Q B
Union College,	Schenectady, N.Y.	W R L
*University of Minnesota,	Minneapolis, Minn.	W L B
*University of Wisconsin,	Madison, Wiss.	W H A
Wanamaker Co., J.,	New York City, N.Y.	W W Z
Warner Bros.,	Oakland, Cal.	K L S
Wasmer, Louis,	Seattle, Wash.	K H Q
Westinghouse Electric & Manufacturing Co.,	Springfield, Mass.	W B Z
Westinghouse Electric & Manufacturing Co.,	Chicago, Ill.,	K Y W
Westinghouse Electric & Manufacturing Co.,	Newark, N.J.,	W J Z
Westinghouse Electric & Manfg. Co.,	East Pittsburgh, Pa.,	KDKA
Western Radio Electric Co.,	Los Angeles, Cal.	K O G
*Western Radio Co.,	Kansas City, Mo.	W O Q
White & Boyer,	Washington, D.C.	W J H
Wireless Telephone Co. of Hudson County,	Jersey City, N.J.	W N O

*Indicates stations licensed to broadcast market or weather reports on 485 metres. All stations listed above operate on 360 metres.

CANADIAN BROADCASTING STATIONS

Name.	*Wavelength.*	*Call Signal.*
Montreal		
Marconi Company	440 metres	C F C F
Dupius Freres	420 "	C J B C
Northern Electric Co.	410 "	C H Y C
Toronto		
Independent Tel. Co.	450 metres	C K C E
Marconi Company	440 "	C H C B
Evening Telegram	430 "	C J S C
Globe	420 "	C H C Z
T. Eaton Co.	410 "	C J C D
Star	400 "	C F C A
Winnipeg		
Geo. Melrose Bell	430 metres	C H C F
Lynn V. Salton	420 "	C K Z C
Manitoba Free Press	410 "	C J C G
Tribune	400 "	C J N C
Regina		
Geo. Melrose Bell	420 metres	C K C K
Calgary		
Geo. Melrose Bell	430 metres	C F A C
Vancouver		
Marconi Company	440 metres	C F C B
Geo. Melrose Bell	430 "	C H C A
Vancouver Daily Sun	420 "	C J C E
Vanc'r Daily Province	410 "	C K C D
Vancouver World	400 "	C F Y C
Halifax		
Marconi Company	440 metres	C F C E

LINK AUSTRALIA, CANADA, AND BRITAIN IN WIRELESS CHAIN

The Amalgamated Wireless Company is arranging for the incorporation of a company in Canada, under whose charter it will erect a great sending station at Vancouver for its Australian news and commercial service. This announcement was made following completion of a contract with the government of Australia for the erection of a great reserving station in Sydney, N.S.W.

It will take two years to erect, there, the greatest wireless depot ever designed. A space containing seven hundred acres on a high hill will virtually be enclosed by wires erected on towers 800 feet above the ground. This will receive messages from Britain, from a station already in existence, and from another station to be erected at Vancouver, to handle the Canadian and American end of the vast business which it is expected will be done. It is intended to be ready to start work on the Vancouver project within a year, so that this wireless service will be in operation, if all goes well, by the end of 1925.

ELECTRIC LIGHT POLES ARE DANGEROUS AERIALS

Electric light and power companies and other organizations using high tension circuits are warning radio amateurs throughout the country to "lay off their pole lines." It is dangerous. Aerials attached to high tension line poles will pick up by induction enough of the high voltage "juice" to do a very good electrocution or start something that the fire department will have to finish. Wash poles, trees, chimneys are recommended, but the fellow that uses a strange pole is flirting with a quick trip through space.

Explanation of Bulletins of U. S. Weatner Bureau

EXPLANATION OF BULLETINS OF U. S. WEATHER BUREAU

The bulletins broadcast from each radio station are of the same general character, are based upon observations at 8 p.m., 75th meridian time, of the date of distribution, and contain reports, forecasts, and warnings.

The bulletins are divided into two parts and invariably begin with the letters USWB.

The first part is a report of actual weather conditions at 8 p.m., 75th meridian time, at certain stations. Each place is indicated by a code letter (or letters) which is followed by figures showing barometric pressure, wind direction, and wind force at that place. The first three figures express actual barometer readings, *in inches*, reduced to sea-level. The fourth figure is wind direction: 1, north; 2, northeast; 3, east; 4, southeast; 5, south; 6, southwest; 7, west; 8, northwest; 0, calm. The fith and last figure is wind force in the Beaufort scale, except when winds of force greater than 9 occur, words instead of figures will be used. If the weather conditions from any station can not be supplied, the initial of the station will be given, followed by the word "missing," and if any portion of a report can not be furnished such portion will be replaced by an equivalent number of the letter "x."

Beaufort Scale of Wind Force.	*Designation.*	*Statute Miles per hour.*
0	Calm	From 0 to 3
1	Light air	Over 3 to 8
2	Light breeze (or wind)	Over 8 to 13
3	Gentle breeze (or wind)	Over 13 to 18
4	Moderate breeze (or wind)	Over 18 to 23
5	Fresh breeze (or wind)	Over 23 to 28
6	Strong breeze (or wind)	Over 28 to 34
7	Moderate gale	Over 34 to 40
8	Fresh gale	Over 40 to 48
9	Strong gale	Over 48 to 56
*Ten	Whole gale	Over 56 to 65
*Eleven	Storm	Over 65 to 75
*Twelve	Hurricane	Over 75

*Whenever winds of force greater than 9 occur, words instead of figures will be used.

The second part of the bulletin consists of wind and weather forecasts and, whenever conditions warrant, information as to storm-centres, storm and hurricane warnings, and advices to shipping. The wind and weather forecasts are for 24 hours, beginning at midnight. The zones to which the forecasts apply are identified by the chart on page 4. Whenever a storm exists that is likely to affect a section, the location and expected direction of movement of the storm-centre will be given, followed by any storm or hurricane warnings and advices to shipping that have been issued.

Example of Bulletin

(First part). USWB J 01662 S 0063 FP 98821 ML 95427 T 95846 NY 93258 DB 92888 LB 95612 CH 94216 H 94645 AV 98282 C 96682 B 00661, etc.

(Second part). Winds off Atlantic coast north of Sandy Hook will be shifting gales with rain. Sandy Hook to Hatteras, northwest gales with rains followed by clearing weather. Hatteras to Florida Straits, strong northwest winds; fair weather. Storm of marked intensity central off New Jersey coast moving northeastward. Storm warnings displayed Hatteras to Eastport.

Translation of Bulletin

USWB=United States Weather Bureau.

	Barometer.	*Wind direction.*	*Wind force.*
J 01662=St. Johns,	30.16	SW	2
S 00663=Sydney,	30.06	SW	3
FP 98821=Father Point,	29.88	NE	1
ML 95427=Montreal,	29.54	NE	7
T 95846=Nantucket,	29.58	SE	6
NY 93258=New York,	29.32	S	8
DB 92888=Breakwater,	29.28	NW	8
LB 95612=Lynchburg,	29.56	N	2
CH 94216=Cape Henry,	29.42	N	6
H 94645=Hatteras,	29.46	SE	5
AV 98282=Asheville,	29.82	NW	2
C 96682=Charleston,	29.66	NW	2
B 00661=Bermuda,	30.06	SW	1

The second part of the bulletin is always in plain language and requires no translation. The chart (in our next issue) shows the location of many of the regular observation stations maintained by the Weather Bureau on the Continent and in the Gulf of Mexico, and the Caribean Sea, also Canadian stations. Key letters are indicated under stations, reports from which are given radio distribution. These reports, supplimented by others picked up from vessels, can be used in the production of a quite comprehensive weather map, which is of much value to navigating officers. Observations radiographed from vessels are in a code prepared by the Weather Bureau for "Vessel Weather Observers," and are easily translated by the use of that code.

INTERNATIONAL CODE CAN BE LEARNED BEST WITH SMALL BUZZER

By R. L. Duncan, Director Radio Institute of America

Radio fans who want to get more out of the air than the broadcast programmes must memorize the International Morse code.

This may be done by visualization. But it is much easier to learn it by sound. A tapping of a pencil will do. The best way, however, is to rig up a little buzzer and hear the real thing.

Get a high-pitched buzzer, an ordinary telegraph key and a common dry battery. They can be purchased in any supply store at a small cost.

Mount the key on a table or desk, allowing plenty of room for the forearm. Connect the battery and buzzer according to the diagram.

When your hand is set have your wrist clear and your thumb resting lightly against the knob of the key. The index and third fingers should be on top and the other two fingers should be curved back into the hand.

The wrist should do the sending—the thumb and fingers acting merely as a guide for the wrist.

The spring in the key should be screwed down just enough to force the key up after each wrist action.

Having noted these preliminaries, the beginner is ready to start.

A dash is held approximately three times as long as a dot.

A dot is held just long enough to get a short, snappy sound from the buzzer.

Take the first letter—dot, dash. Repeat several times. Listen intently. Note the difference between the dot and dash. Watch your position.

Don't be in a hurry. You will memorize the code soon enough. Make each character concise in itself. Don't leave any space between the dot and the dash of the first letter.

When you have learned the "A" of your wireless ABC, take the next letter. It is much harder. Stop after each effort.

Don't take more than four letters a day. Be sure you know those before you go on to the next group.

When you feel that you have mastered the alphabet, learn the code for the period, comma, question mark and error. No need to bother about other characters.

Don't expect to start plucking messages out of the air immediately. It will take a little time before you will be sure of yourself. But once you get started, you will realize that there is lots more in the air—

Than the voices and concerts sent broadcast.

RADIO TRADE REVIEW

NEW HEAD NAMED FOR RESEARCH DEPARTMENT OF WESTINGHOUSE ELECTRIC CO.

S. M. Kintner, who is well known for his research and engineering work in the development of radio apparatus, has been appointed manager of the research department

S. M. Kintner.

of the Westinghouse Electric & Manufacturing Company, succeeding C. E. Skinner, who has been made assistant director of engineering in the Westinghouse Company. He will be located in the research laboratory building near East Pittsburgh, Pa.

HONEY COMB COILS

The many amateurs who are now fitting up apparatus for the reception of radio signals, music, etc., will be interested to know that they can procure honey comb coils to suit their requirements, made to their own specifications, if desired, at a very reasonable price and on short notice. A special set of coils has been designed suitable for receiving all the interesting broadcasting stations, including Arlington, Va., with the greatest signal strength. These coils may be obtained by communicating with Mr. W. Newsome, Weston, Ontario, who is prepared to accept orders immediately.

INVENTOR OF RADIO STATIC ELIMINATOR IS AWARDED PRIZE

The Liebermann Memorial prize, consisting of the interest for one year on $10,000, has been awarded to Roy A. Weagant, consulting engineer of the Radio Corporation of America, with headquarters in New York city, for his invention of a static eliminator. This prize is given annually to the man judged to have contributed the best work of the year toward the advancement of radio.

The static eliminator invented by Mr. Weagant is "a combination of balanced circuits and wave traps which choke the static disturbances induced in the antenna, leaving only the signals to be received free to pass though the circuit," a writer in Radio News explains.

The invention was achieved by Mr. Weagant after lengthy experiment carried out under the most unfavorable circumstances in various parts of the country during the seasons when statics were heaviest. The Weagant static eliminator, while not yet perfected to such a degree as to eliminate static entirely, has been used with satisfactory results in several of the high-power and government stations engaged in long distance communication.

Sudbury, Ontario, technical school will have the best equipped amateur radio station in Ontario within a month, the school board having ordered installation of the necessary amplifiers and additional equipment to complete the set already in use. Public concerts will be given for the benefit of the citizens.

RADIO CLUB REPORTS

On this section the Editor will be pleased to publish reports of any of the various Radio Clubs. Such reports should be submitted in the exact form in which they are to appear, the Editor, however, reserving the right to edit and curtail the reports if necessary. Papers of special interest read before such Clubs will be also acceptable for publication.

RADIO RESEARCH CLUB OF CANADA

At the recent annual election of officers the following were chosen:—

Hon. President—Prof. Rosebrugh.
President—C. A. Culver, Ph.D.
Secretary-Treasurer—C. R. Fraser.
Executive Committee—Messrs. Duncan, Galbraith, Dancey and C. E. Williams.

The last meeting of the Club was held under very unfavorable weather conditions. Those present, however, enjoyed a very interesting talk given by Mr. Silver on the Development of Wireless Communication at Shawinigan Falls.

THE PRINCIPLES UNDERLYING RADIO COMMUNICATION

The Government Printing Office at Washington has just issued an elementary book on radio communication, entitled "The Principles Underlying Radio Communication" and known as Signal Corps Radio Communication Pamphlet No. 40, Second Edition. The first edition was prepared during 1918. The revised edition has been considerably increased in size. Some obsolete material appearing in the first edition has been replaced, and considerable new material has been added.

There is new material on batteries, ordinary wire telegraphy and telephony, line radio communications, transformers, antennas, including coil antennas and direction finders, transmitting apparatus, particularly arc converters, electron tubes, and electron tube apparatus, a. c. plate supply, and radio telephony. Numerous circuit diagrams are given, and the construction of antennas and ground connections is described. Besides other useful practical information, the book contains a table of dielectric constants, copper wire tables, wave length tables, the International Code, safety precautions for radio stations, information regarding radio laws and regulations, and a list of radio publications including those issued by the Government. A complete index has been added. The revised edition contains over 600 pages and more than 300 illustrations, many of them photographs.

A copy of this book can be purchased for $1.00 from the Superintendent of Documents, Government Printing Office, Washington, D.C. This price includes postage in the United States and its possessions, and in Canada, Cuba, Mexico and Panama. For other countries, an extra allowance of 20c. should be made for postage.

AMATEUR STATION IS HEARD IN FRANCE

The American Radio Relay League has received word from Pierre Corrot, editor of a Paris wireless magazine, that French amateur radio stations have received messages transmitted by the University of Vermont stations at Burlington, Vt., in a trans-Atlantic test being conducted under the auspices of the league. This is the first record of an American amateur station being heard in France.

W. A. O. O.

The 4th General meeting of the 1922 season, W.A.O.O., was held on April 13th in the Electric lab. of the old S.P.S. building, U. of T. Mr. Fred Burgess gave his contribution to the Homcharger contest with a lecture on loop aerials. His data were very complete, and samples of loops used in his experiments were on display. Mr. E. J. Bowers gave an interesting talk on the system of modulation for telephony as now used at 3CZ. 3CZ has been reaching out on voice rather remarkably of late, and his circuit was carefully discussed by many members.

A few remarks about spark vs. C. W. showed that W.A.O.O. men are rapidly swinging over to C. W., and only a very few of our members are now using the older method. The general feeling seems to be that if we hope to hold the Relay game against the new Broadcasting phase, we must pin our faith to C. W. and bid good-bye to our old standby, the Spark.

The Convention committee report favorable progress, but will have no definite announcement to make for a week or so.

The President advised all local men to get busy and clean up their lightning grounds, etc., as the Hydro are talking about making an inspection tour to see that all amateurs are observing the Fire Underwriters' regulations in this respect. The meeting adjourned at 10.30 p. m.

THAT CONVENTION!!

Gang! Get ready; save up the shekels for a walloping big Convention-Exhibition, to be held during the last week of the Canadian National Exhibition, next September. Lets make it a National Affair and Get-Together of the Canadian Fraternity. We want our American neighbors over here for it, too. Come and see the World's Largest Annual Exhibition and attend the Radio Convention, too—all for one car fare. How about it, you Westerners? Will you come? All roads lead to Toronto for the C. N. A. R. Convention, September 8th and 9th, 1922! Full details later.

At a recent meeting of the W.A.O.O., Wireless and Aviation News was highly commended for its attitude toward the Association, and it was unanimously decided that a committee be appointed to meet the Editor with a view to making it the official organ of the W.A.O.O. and affiliated organizations.

DEPARTMENT OF THE CANADIAN NAVAL SERVICE

Radiotelegraph Regulation No. 104 Amendment

Paragraph (i) of Section (a) of Radiotelegraph Regulation No. 104 is hereby cancelled, and the following is substituted therefor, effective 15th February, 1922:—

(a).....

(i) When direct communication by messenger, visual signals or other method between ship and shore is impracticable and then only for the purpose of exchanging with the nearest coast station messages relating exclusively to the business of the ship.

AERONAUTICAL DIGEST

BRITISH COMMERCIAL AIRCRAFT

The following is based upon some notes recently circulated by the commercial aviation section of the British Air Ministry. It describes five of the most representative of British commercial aircraft at present in use, especially with reference to the traffic at the Croydon Aerodrome.

The D.H. 18 is a single engine biplane, which has limousine body with seats for eight passengers. For freight the space available is 255 cubic feet. The engine is a Napier-Lion, which gives 500 h.p. Fully loaded, the D.H. 18 weighs 7,000 lbs., of which about 1,940 lbs. is available for freight and passengers. When on passenger service the eight passengers are allowed about 500 lbs. of luggage. With this load the maximum speed is about 124 miles per hour at 1,000 feet altitude, and 120 miles, 5,000 feet altitude. Fuel is carried to last about 3¼ hours, giving a range of about 400 miles. This machine accomplishes the flight to Paris in about 2¼ hours.

The Bristol ten-seater, which has just been completed, is a biplane, fitted with the Napier-Lion engine, and having a cabin for eight passengers and an open cockpit for a pilot and mechanic. With a crew of two, and fuel and oil sufficient for a 400-mile flight, a commercial load of 2,080 lbs. out of a total weight of 7,100 lbs. can be carried. The maximum speed is about 120 miles per hour, and the speed at 5,000 feet altitude is about 118 miles.

The Vickers-Vimy is the commercial model of the well-known bombing type which flew across the Atlantic and from England to Australia. It is a twin-engine machine, the engines being Rolls Royce Eagles of about 360 h.p. each. A cabin is provided with seats for ten passengers. The maximum speed is approximately 103 miles per hour loaded to the maximum permissible weight of 12,500 lbs. with a commercial load of 3,065 lbs. It has a speed of 97 miles per hour at 1,000 feet altitude and 87 miles per hour at 6,000 feet.

The Handley-Page W. 8 is a twin-engine machine having two Napier-Lion engines of 500 h.p. It has a cabin with seating capacity for fifteen. The maximum permissible weight is 12,500 lbs., of which the commercial load represents 2,207 lbs. Loaded up to the maximum the machine gave in the Air Ministry competition last year a maximum speed of 119 miles and a cruising speed of 88 miles an hour.

The Vickers-Viking III. is an amphibious flying boat, i.e., capable of landing with equal ease on land or water. It has been employed in experiments to determine the practicability of using the Thames as an aerodrome, with satisfactory results. Several flights have been made between the Thames and London and the Seine near Paris. Three passengers may be carried in an open cockpit. The engine is a Napier-Lion. The maximum speed is approximately 120 miles per hour, the minimum speed 52 miles per hour, and the cruising speed 82 miles per hour.

Several new types of British commercial aircraft are now in course of construction, some of which will be introduced into the continental service during the spring of 1922.

AIR FORCE NEWS

The Aero Club, have written to the Air Board asking that two hangars be placed at the disposal of the Club for visiting planes at Leaside, Ont.

It is understood that negotiations are now about complete between the Aero Club of Canada and the Wardens of the St. James Rectory, Adelaide Street East, Toronto, so that the Club will shortly be able to make this large and attractive property a home for the organization.

Announcement is made by the Curtiss Aeroplane and Motor Corporation of the appointment of Mr. Geo. W. Browne as manager of their commercial sales department, with Mr. F. W. Whitney assistant.

Roald Amundsen, the explorer, is entitled to some credit for his interest in aeronautics and his belief that he can use a metal monoplane in exploring in the region of the North Pole. He proposes to fly from Point Barrow to North Cape, Norway. At the present time he is testing his machine in a flight from New York to Seattle.

The French Air Ministry reports that the distance covered last year by French commercial planes was nearly 2,000,000 miles. The number of flights was 6,000 and the number of passengers carried was 10,330. Postal matter weighing 20,758 lbs. was carried.

Sixty aeroplanes have been entered at New York City for the first of the national flying meets sanctioned by the Aero Club of America. The first meet will take place Sunday, April 30th.

Miss Jeanette Vreeland, the opera singer, and Mr. Bert Acoste, recently sang into a radio transmitter while several thousand feet above the earth in an aeroplane. The experiment was a great success.

The death of the famous English aviator, Sir Ross Smith, is a sad blow to flying men. His accidental death occurred while preparing for a flight around the world. Sir Ross flew in 1921 from England to Australia.

Mr. Thos. Spence, Provincial Secretary of Canadian Air Force in Saskatchewan, was in Toronto the later part of March on his way to Ottawa.

The percentage of the personnel of the Air Force by provinces is as follows:

	Officers.	*Men.*
Ontario	34%	44%
British Columbia	14%	10%
Alberta	8%	9%
Saskatchewan	12%	10%
Quebec	12%	9%
Maritime Provinces	9%	8%
Manitoba	11%	10%

STARTING AERO ENGINES AT LOW TEMPERATURES

The work carried out by Professor Robb at Edmonton during this season and last can now be summarized in the form of a procedure for starting aero engines at various low temperatures.

The problem, as presented to Professor Robb, was that he was to assume that the engine was in an aeroplane which was forced to spend a night in the open away from the base, and it was decided to know the best method that the crew should adopt in order to start the engine the following day.

It is assumed that while the engine has been still hot the cooling system has been completely drained or that an efficient anti-freeze mixture is available. It is also assumed that the battery has been removed from the machine and kept at ordinary room temperature and also that a supply of commercial ether at room temperature is available.

The first operation is to ease up the motor by doping with about one-half pint of gasoline and turning the engine over until it is quite free. In this connection it is important to see that there is no ice in the water pump before any attempt is made to turn the engine over.

The next operation is to dope the engine with about one-quarter of a pint of a mixture of ether and gasoline. The mixture which is most suitable to different temperatures is given in a list below.

It is important that this initial doping should not be too liberal, as it has been found that if the doping is slightly increased the engine does not start well.

As soon as the engine starts to fire an additional one-quarter of a pint of the mixture is pumped into the intake manifolds, and this should suffice for the engine to begin to fire on gasoline from the carburetor which has been flooded meanwhile.

The motor is allowed to run for about two minutes until it is warm enough to take water at ordinary room temperatures, but care must be taken that the engine is not run too long without water.

As soon as the cooling system has been filled the engine should be started again and run for some little time to see that the cooling system is functioning properly.

If the engine starts to boil in an unduly short time examination should be made for an accumulation of ice that may have stopped the system.

Experiments will be carried out on the best method for handling the oiling system, but at present it is considered advisable to drain the engine immediately on landing and fill it up with oil at at least room temperature when commencing to start. It is essential that the battery should be charged to specific gravity of over 1.25, and this suggests an extra battery should be carried. (The experiments were carried out on a Liberty engine. If the engine is fitted with magnetos care should be taken to see that the contact points and the distributor are clean and in good order before attempting to start).

The priming nozzles serving the intake manifolds must be sufficiently large to permit liberal doping quickly, and in the case of a second cold start being required soon after the first, care should be taken to see that these nozzles have not become frozen up.

The priming device requires to have sufficient capacity to permit quick doping with ether mixture and the storage tank to serve the priming pump should have capacity for at least one-half pint of mixture to permit two dopings.

Professor Robb used a pump constructed from a grease gun which had a bore of 1⅛ inch and a stroke of 7 inches, and he states that a standard priming pump is too slow for this particular service.

Professor Robb experienced no difficulty with the spark plugs in almost 100 starts, but it is considered advisable to remove the plugs from the engine and heat them over a fire before attempting to start.

The proportions of the mixture for doping, suitable for different temperatures, is as follows:—

Temperature.	Gasoline.		Ether.
+20° F. and above	Pure		
Zero to 20° F.	3	to	1
—15° F. to Zero	2	to	1
—30° F. to —15° F.	1	to	1
—37° F.		Pure (warm)	

At the higher temperatures it has not been necessary to warm the mixture, but a start at —37° F. indicates that at this temperature ether requires to be warm, that is, at room temperature. The carburetor should be flooded in all cases before starting, and the spark should be advanced immediately the engine begins to fire. The usual position of the throttle for starting the Liberty engine is about one-fifth open.

The ether used in these tests has been put up in 1 lb. sealed tins marked "Mallinchrodt Motor-Ether."

In connection with this research a number of interesting points have been raised, and it is suggested that if any further information is required, application should be made to the Secretary of the Air Board.

AERIAL SURVEY OF EUROPE

Brigadier General William Mitchell, Assistant Chief of the U. S. Air Service, just returned from a three-months' survey of aeronautics in Europe, is urging the immediate establishment in the United States of an organized system of airways. He sums up the European situation in the following manner: "Europe is making great strides in the development of aviation, but in its actual application, as illustrated by the bombing manoeuvres last summer, we are in the lead. What the United States needs is an organized system of airways, Federal laws and some form of tangible encouragement for its civilian operators. Some 12 or 15 aircraft lines are in operation in England, France, Holland, Belgium and Italy. The air port of London (Croydon, and Paris, Le Bourget) are well organized and systematically conducted, with custom houses, hotels and means of communication with the city. People in Europe are patronizing the air lines as a utility. During the month of February about 1,400 passengers were cleared at the Paris Air Port. The French are running the longest lines—Paris to Bucharest, with an extension to Constantinople. In all the larger European nations aviation is being developed with the idea that it is the first line of defense, and subsidies of 50 per cent. or so on the original cost and the cost of operation are in effect for privately-owned aircraft.

"There is no visible aviation in Germany, but they are doing great things there. The gliding flights are evolving types with motors of only 5 h.p., which means a very cheap ship.

"The French intend and the Germans expect to fly the Atlantic. Airships have not been scrapped, but are sure to be the long-distance carriers. The German-Spanish-Argentine Zeppelin line between Seville and Buenos Aires is going through."

General Mitchell flew in every country visited, personally testing out some fifteen new types of aircraft.

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